LIFE HISTORY STUDIES OF *POA PRATENSIS* L.

BY

ROBERT BURNS MUSGRAVE

B.S., University of Illinois, 1936
M.S., University of Illinois, 1938

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY IN AGRONOMY IN THE
GRADUATE SCHOOL OF THE UNIVERSITY
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LIFE HISTORY STUDIES OF *POA PRATENSIS* L.

Kentucky bluegrass, *Poa pratensis L.*, is the most important pasture and lawn grass in North America. This is true even though it has several undesirable characteristics, chief among which is its summer dormant period. Another drawback is the long time required to effect complete germination of viable seed. Life history studies of Kentucky bluegrass were undertaken with the belief that a thorough understanding of the plant's life cycle would shed light on these and other problems.

The life history of Kentucky bluegrass was traced by observing its developmental behavior during germination and during the growing season, following fall and spring plantings. It was also traced in old established sods, some of which were clipped and some unclipped. Sods and seed from 40 selections, previously chosen because of certain variations exhibited, as well as sods and seed from ordinary commercial origin were used for study. The observations were recorded in photographs, tables, and descriptions. In some instances after locating and describing a stage of the life cycle in a normally developing plant, experiments were performed to delay, speed up, or otherwise alter the stage of development.

Poa pratensis L. was found to follow essentially the same developmental sequence during germination as reported for other members of the grass family. However, it differed markedly from many other grasses by requiring a comparatively long period for the complete germination of its viable seeds. Soaking seeds for 48 hours and then subjecting them to a temperature of 7 degrees Centigrade for seven days before germinating them under standard conditions increased the rate and percentage of germination. The germination of three-year-old seed was benefited less by a cold treatment than was one-year-old seed.

Seed produced under cloth bags germinated faster and with more vigor at first than seed produced in the open, but the latter exhibited the most vigor after being on the germinator thirty days. Seeds produced under bags possessed larger areas of soft starch and more shriveling than those produced in the open.

The germination rate of seed from 40 selections of *Poa pratensis* L. varied markedly, indicating that selection may be practiced to eliminate the slow and poor germinations found in most commercial lots of *Poa pratensis* L. seed.

Kentucky bluegrass leaves begin their development as lateral, alternate ridges appearing acropetally beneath the apex of the growing point. First to develop is the blade, then the ligule, and last the sheath. The ligule became discernible when the blade was 3 to 5 mm. long. The blade almost reached its maximum length before the sheath elongated. Kentucky bluegrass growing in sod maintained four green leaves per culm rather constantly until heading time. Variations in form occurred in Kentucky bluegrass leaves when produced on different strains, on sterile and fertile culms, and at different times.

Tillers develop from axillary buds. In sod, the majority of the tillers began growth in late fall or winter. The prophyllum is the first leaf of a tiller. It is two keeled and otherwise like the palea and is placed on the side of the tiller next to the parent stem. Subsequent leaf initials of the tiller arise in a plane perpendicular to that in which the leaves of the parent stem are formed. All of the tillers observed on 40 selections and numerous other Kentucky bluegrass plants were intravaginal. Usually the connection between parent culm and tiller was broken so that tillers became independent culms before they were one year old.

Rhizomes also come from buds at nodes. However, they were different from tillers in that they had no distinguishable prophyllum, they grew perpendicularly from the parent stem, and scales instead of leaves were produced by the growing point. A rhizome scale consists of a leaf blade 1 to 3 mm. long, a ligule, and a well-developed sheath. Scales appeared rolled in the bud, whereas tiller leaves were folded in the bud. They functioned to protect the growing point of the rhizome and possessed axillary buds capable of developing into additional rhizomes. Rhizomes commenced to elongate in June and most of them terminated in above-ground culms in August.

The development of the panicle in Kentucky bluegrass started in late winter. At that time the growing points of culms possessing one or more axillary tillers elongated and formed branch initials instead of leaf initials. These branch initials produced branches of the second order and eventually all branches terminated in spikelets. Spikelet formation progressed from the tip to the base of the panicle. Florets within a spikelet formed in the order from base to tip and that order was maintained for the parts within a floret. Anthers were exserted at flowering time and pollen was essential to seed formation. However, about 90 percent of all types of Kentucky bluegrass reproduce apomictically. Injury resulting from emasculating florets of Kentucky bluegrass reduced seed setting, but pruning the panicle and placing a bag over it caused no reduction.

Spaced fall plantings of Kentucky bluegrass developed sufficiently to produce some seed the first spring. Such plants tillered freely and produced large numbers of rhizomes during the first growing season. Similar plantings made in the spring produced no seed and few rhizomes during the first year of development.

The yearly cycle of development in sod starting with the emergence of rhizomes in the fall was as follows. Approximately 50 percent of the culms produced axillary tillers during the winter and the growing points of these culms initiated panicles. With the advent of warm weather growth was accelerated and the axillary tillers emerged to produce most of the flush of green color seen at that time. Panicles emerged early in May and seed ripened in mid-June. New rhizomes were produced during the summer months and emerged in the fall, thus completing the life cycle.

VITA

The writer was born on a farm near Hutsonville, Illinois, April 15, 1913, and lived there until going to college. After being graduated from Hutsonville Township High School in May, 1931, he farmed with his father for one year and a summer and then entered the University of Illinois. Following a four-year course in general agriculture with emphasis on agronomy and mathematics, the B. S. degree was conferred in June, 1936.

An assistantship in crop production enabled the writer to do graduate work in the Agronomy Department and receive experience in teaching and crop experimentation. He received the M. S. degree in February, 1938. Work was immediately begun on an advanced degree with a major in crop production and a minor in botany.

The writer has been elected to membership in Alpha Zeta, Gamma Sigma Delta, Alpha Tau Alpha, Sigma Xi, and Phi Kappa Epsilon.